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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/726,860	11/30/2000	Etsuo Morita	09792909-4715	1967

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EXAMINER

ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
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1765

18

DATE MAILED: 06/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/726,860

Applicant(s)

MORITA, ETSUO

Examiner

Matthew A. Anderson

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-5 and 7-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-5 and 7-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 November 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3-5, 7-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kiyoku et al. (US 6,153,010) in view of Sugiura (US6,015,979).

Kiyoku et al. discloses methods of growing nitride semiconductors. Figs. 6a-6C show an embodiment of the methods presented. The method is described in col. 13 (lines 25+) and col. 14 lines 1-65. A monocrystalline substrate (11) is overlaid with an underlayer (also known in the art as a buffer layer). The material choices for the substrate are given as sapphire (known chemically as Al_2O_3), spinel (chemically, MgAl_2O_4), SiC of any of the 6H, 4H and 3C polytypes, ZnS, , GaAs, Si, and (although they are less preferred) ZnO or $\text{La}_x\text{Sr}_{1-x}\text{Al}_y\text{Ta}_{1-y}\text{O}_3$. (see col. 7 lines 20-25.) The buffer layer can be AlN, GaN, AlGaN, or InGaN. (col. 13 lines 10-20). The mask is described as being one or a combination of oxides and nitrides such as silicon dioxide (SiO_x), silicon nitride (Si_xN_y), titanium oxide (TiO_x) and zirconium oxide (ZrO_x). Also the metals with melt in points greater than 1200°C can be used. These include W, Ir, Pt, Ti

etc. Stripe, dots or lattice patterns are disclosed for the mask in col. 8 lines 25-35. In col. 14 lines 33-40 it is disclosed that repeated cycles of growth mask formation followed by nitride growth. Polishing the grown nitride is disclosed in col. 13 lines 25-40 to provide a flat growth surface before additional growth iterations are performed. In col. 12 lines 5-15 it is disclosed that the dissimilar substrate (i.e. the basal layer) may be removed from the formed device. The use of a superlattice or graded buffer layer (the first crystal layer) is described in col. 20 lines 20-30 as formed from alternating nitride layers having different compositions.

Kiyoku et al. does not suggest the same method of forming the growth masks as is used in the application.

Sugiura et al. discloses the formation of growth masks for nitride epitaxy as in Fig. 11. This is disclosed in col. 18 lines 9-35 as consisting of a nitride layer on which a SiO₂ layer is formed. This layer is then patterned using a electron beam resist and patterned using a dry etching technique. This suggests etching the underlying nitride layer since the oxide is completely etched through to expose the underlying layer. Also suggested in col. 12 lines 57+ is, after the mask is patterned, the mask is cleaned with acid. Acid cleaning suggests etching and removal after patterning.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the references cited because Kiyoku et al. discloses the formation of patterned striped growth masks on a nitride layer and Sugiura et al. discloses an alternative method of forming such masks on a nitride layer. The

motivation for the combination is the increased process flexibility thus afforded and the expectation of better results from the removal of possible contamination from the mask.

In respect to claims 1 and 15, it would have been obvious to one of ordinary skill in the art at the time of the present invention to perform III-V nitride compound growth as per the claims including a second growth step through the etched mask and the etched first crystal (i.e. buffer layer), a second etching step to form the second layer through the second pattern, a third nitride growth step, and at least partial removal of the second mask layer because this was the essence of Kiyoku's Figs. 1A-1C and 6A-6C with the above modification of Sugiura et al.

Further in respect to claims 1 and 15, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the second etching step include removing at least part of the mask pattern because such removal and acid cleaning of parts of the mask pattern is described by Sugiura et al. Sugiura et al. suggests (col. 12 lines 57+) the acid cleaning (i.e etching) of the mask before growth of a nitride through the openings in it.

In respect to claim 3, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the mask pattern include an underlayer and an upper layer because Kiyoku et al. discloses multi-layer growth masks.

In respect to claim 4, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form the mask from different materials having different properties (such as SiO_2 and Si_3N_4) because such is explicitly disclosed by Kiyoku et al.

In respect to claim 5, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the windows of the first mask and the second mask do not overlies one another in the direction of the thickness of the crystal because such mask overlay is shown in Fig. 6A-6C of Kiyoku et al.

In respect to claims 7 and 16, it would have been obvious to one of ordinary skill in the art at the time of the present invention to remove the basal layer after the growth of the device layers of nitride is completed because such is suggested by Kiyoku et al.

In respect to claims 8 and 9, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form a buffer layer (i.e. an inner layer) of differently composed III-V nitride layers because such is suggested by Kiyoku et al. in such an epitaxial process.

In respect to claims 10 and 11, it would have been obvious to one of ordinary skill in the art at the time of the present invention to form the first mask layer in stripes arranged in one direction in a plane almost parallel to the surface of the basal plane because Kiyoku et al. discloses flattening the layer before subsequent growth and such planarization would have been anticipated to those of ordinary skill in the art to produce a better surface.

In respect to claim 12, it would have been obvious to one of ordinary skill in the art at the time of the present invention that the first and second mask pattern include elements arranged in two directions in a plane almost parallel to the surface of the basal body (i.e. in a lattice pattern) because such is explicitly suggested by Kiyoku et al.

In respect to claim 13, it would have been obvious to one of ordinary skill in the art at the time of the present invention to use silicon oxide or silicon nitride masking materials because such were explicitly suggested by Kiyoku et al.

In respect to claim 14, it would have been obvious to one of ordinary skill in the art at the time of the present invention to use a substrate (i.e. basal body) of sapphire, or SiC or GaAs etc. because such is disclosed by Kiyoku et al.

Response to Arguments

Applicant's arguments filed 4/11/2003 have been fully considered but they are not persuasive.

The argument that the references do not suggest the etching of the mask before the third step of growing the third layer is not convincing. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Since Sugiura suggests acid cleaning (i.e etching) the mask, the argument does not pass scrutiny.

The argument that Kiyoku does not teach the built up layered structure is not convincing. Kiyoku et al. suggests repeatedly performing the growth using the masks control lattice defects. (Col. 14 lines 33-40).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the references deals with nitride epitaxial lateral overgrowth. Sugiura suggests cleaning the masks used in such a process. Kiyoku et al. uses such masks and growth iteratively, as in the claims. The claim does not require the mask to be completely removed as the applicant seems to argue in paper 15 page 7. Thus, the examiner has presented the rejections above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703)

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872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
June 18, 2003

Matthew Anderson
A.U. 1765